

Skyler Anderson

Plague and population in early medieval Europe

One of the least studied aspects of the transition to the Early Medieval period is the change in health and illness. This transitional period has been studied from many angles but the study of health is lacking. What is primarily researched is the Justinianic plague, of which we have some documental evidence. Because of its severity the Justinianic plague caused an epidemiological adjustment in developing barbarian states in the post-Roman transitional period responsible for setting the stage for economic development in an environment of low population density. This low population density had a dramatic effect on the nature of rebounding populations, which changed subsistence strategies in the process of adapting to the new population dynamic. The period immediately following the outbreak of the plague has traditionally been viewed as a decline, but recent evidence may require a reevaluation of this historical standard. Research methods have shown that there was indeed a shift in the health of populations in this period, with disease playing a large role in modifying the mortality regimen. However, the evidence is quite contrary to traditional belief that poorer diets and unhealthier populations characterized this period. It is true that populations numerically declined, but this is due to the outbreak of plague and other disease, which masked other improvements in health. Finally, the regional manifestations of the developing demographic dynamics resulting from the plague would result in the decline of the Byzantine Empire concurrent with the rise of western barbarian states.

Narrative of the Plague

Reportedly named after its most infamous victim, the Emperor Justinian, the Justinianic plague swept across Europe and the Near East beginning around the year 540. Procopius, historian of the Byzantine Wars, who lived between the years 500 and 560 AD and accompanied Belisarius on his campaigns in Italy, North Africa, and the East, writes of the plague in his *History of the Wars* stating that “during these times there was a pestilence, by which the whole human race came near to being annihilated.”¹ Procopius goes on to say about its origins,

It started from the Aegyptians who dwell in Pelusium. Then it divided and moved in one direction towards Alexandria and the rest of Aegypt, and in the other direction it came to Palestine on the borders of Aegypt; and from there it spread

¹ Procopius. *History of the Wars, Books I and II The Persian War*. Translated by H. B. (Henry Bronson)

*over the whole world, always moving forward and travelling at times favourable to it. For it seemed to move by fixed arrangement, and to tarry for a specified time in each country, casting its blight slightly upon none, but spreading in either direction right out to the ends of the world, as if fearing lest some corner of the earth might escape it.*²

During the year 542 the disease spread from Egypt across the Byzantine Empire, eventually reaching Constantinople in the spring, where it remained for four months. Procopius notes that during the plague it was difficult to see a person on the streets of Constantinople, and if you did they were usually carrying a dead person. He also mentions that the “disease always took its start from the coast, and from there went up to the interior.”³ Symptomatically, he cites the characteristic “buboes” that appeared on the body after infection and he even talks about an autopsy during which the physicians discovered carbuncles under the bubo, which is a common identifier of plague. Procopius mentions that the disease especially threatened pregnant mothers, causing the death of the baby or mother, and sometimes both.⁴

Procopius is a useful source because he describes the origins of the plague but for investigating the effects of the plague in Western Europe we need to look at sources which originated there. Among these is Gregory of Tours, who writes about the plague in his *History of the Franks*. Gregory mentions a disease that caused “great swellings in the groin” and ravaged parts of Gaul in the time of Saint Gall.⁵ According to Gregory, Gall prayed that his district of Clermont-Ferrand would be spared, and the Angel of the Lord appeared to him and said his district would be spared as long as he lived, but that he was to live only eight more years. Accordingly Saint Gall died eight years later in the year

² Procopius, *History of the Wars*, Book I, Ch. XXII.

³ Procopius, *History of the Wars*, Book I, Ch. XXII.

⁴ Procopius, *History of the Wars*, Book I, Ch. XXII.

⁵ Gregory of Tours, *A History of the Franks* (New York: Penguin Classics, 1974). Book IV, Ch. 4, 199.

551, so the estimated date based on Gregory's text for this first outbreak of plague in Gaul was around 543. If this is true, then this event occurred at around the same time as the plague outbreak in Constantinople, implying that the disease had rapidly spread in multiple directions from Egypt. Gregory describes the devastation of a later plague episode in Auvergne during the year 571.

When the plague finally began to rage, so many people were killed off throughout the whole region and the dead bodies were so numerous that it was not even possible to count them. There was such a shortage of coffins and tombstones that ten or more bodies were buried in the same grave.⁶

The characteristic symptom he describes as a sore, "like a snake's bite," appearing near the groin or the armpit.⁷ Gregory writes about the outbreak of plague, and deaths of significant persons due to plague *repeatedly*, meaning that the plague occurred over a period of time and travelled around the regions of Gaul acting somewhat endemically for a period of time. When King Guntram is asked to reply to a call to arms from his nephew Childeric against the Lombards in 588, Guntram replies, "I will never send my troops into Italy... for in doing so I should encompass their certain death. A terrible epidemic is raging in that country at this moment."⁸ From this we can tell that Gregory knew of the scope of the plague in other regions and if we are to assume his words as true, we can believe that the King of Burgundy knew about it as well. Further, the plague determined the diplomatic course for this king, suggesting that it was such a prominent factor that it could decide the fate of military campaigns or even kingdoms.

In this same year Gregory writes how the plague spread to Marseilles,

A ship from Spain put into port with the usual kind of cargo, unfortunately also bringing with it the source of this infection. Quite a few of the townsfolk purchased objects from the cargo and in less than no time a house in which eight

⁶ Gregory of Tours, *The History of the Franks*, Book VI, Ch. 31, 226.

⁷ Gregory of Tours, *The History of the Franks*, Book VI, Ch. 31, 226.

⁸ Gregory of Tours, *The History of the Franks*, Book IX, Ch. 20, 508.

*people lived was left completely deserted, all the inhabitants having caught the disease... Some time passed, and then like a cornfield set alight, the entire town was suddenly ablaze with this pestilence... At the end of two months the plague burned itself out. The population returned to Marseilles, thinking themselves safe. Then the disease started again and all who had come back died.*⁹

Gregory goes on to say that “on several occasions later on Marseilles suffered from an epidemic of this sort.”¹⁰ Gregory died in 593, suggesting that there were numerous outbreaks of plague in the short five-year span between 588 and 593.¹¹ The reoccurring nature of infection at Marseilles can be possibly explained in two ways. The higher population density of Marseilles allowed the plague to remain in the city, affecting those who had not already been infected in earlier outbreaks when they returned, or the disease was repeatedly introduced by ship, prompting multiple outbreaks. Ship-based transmission may also account for the early spread of the disease to Gaul from Egypt. Plague outbreaks presumably continued into the seventh century in Gaul, but after the death of Gregory of Tours there is not a clear primary source to confirm continuing outbreaks.

The ability of the plague to spread by ship is also a prerequisite for its spread to the English Isles, which may be accounted for in Bede’s *Ecclesiastical History of the English People*. Bede states in 664,

*A sudden plague, which first decimated the southern parts of Britain and later spread into the province of the Northumbrians, raged for a long time and brought widespread death to many people... The plague was equally destructive in Ireland.*¹²

This is a later date, but it seems to be the first instance where an outbreak of plague may fit with the typical geographic method of transmission and where Bede mentions it for its

⁹ Gregory of Tours, *The History of the Franks*, Book IX, Ch. 21, 510-511.

¹⁰ Gregory of Tours. *The History of the Franks*, Book IX, Ch. 21, 510.

¹¹ That span is even shorter if you consider that the *Historia Francorum* was completed in 591.

¹² Bede, *Ecclesiastical History of the English People* (New York: Penguin Classics, 1990), Book III, Ch. 27, 194-195.

own sake. There is an earlier account preceding this one describing an Irish man's recovery from plague due to a relic of King Oswald wherein Bede places the event "at the time of the great plague that swept Britain and Ireland," which may imply that there was some greater outbreak event earlier than 664.¹³ It is uncertain if these diseases are episodes of Justinianic plague. Bede usually gives us the word "plague" without describing symptoms, but the breadth of the disease seems to imply something more severe than dysentery, cholera, or malaria. Bede also henceforth mentions plague-related deaths numerous, suggesting some kind of recurring epidemic like that of Gaul.¹⁴ There is an instance where the buboes of Justinianic plague may be diagnosed when Bede tells the story of Queen Etheldreda. While she lay ill, her physician Cynifrid was asked to lance a tumor that was under her jaw.¹⁵ This case is still too vague to clearly diagnose it as bubonic plague but it is tantalizing. If this is the same disease that had been occurring in Gaul and in Constantinople, then the later introduction of this disease into the British Isles may be explained by the distance of these lands from the Mediterranean, which would appear to have been a highway for transmission in the form of interstate commerce and higher population density. Bede seems to mention disease only in passing and usually with religious implications, but from his account we can tell that some significant disease event was happening in the British Isles after 664. Whether this event was Justinianic plague would be more strongly confirmed if we had greater knowledge about the plague cycle in Gaul after the death of Gregory of Tours.

¹³ Bede, *Ecclesiastical History*, Book III, Ch. 13, 163. This plague may have been "the first great plague" mentioned in the Annals of Tigernach. It was likely small pox. See John Maddicott, "Plague in Seventh Century England" in Lester K. Little, ed. *Plague and the End of Antiquity: The Pandemic of 541-750*. 1st ed. Cambridge University Press 2006. ff. 171.

¹⁴ The Latin word "pestilentia" is often translated into plague or pestilence but itself is no more specific than these terms. The death of monks and nuns, whose monasteries were usually isolated, shows that this disease was affecting rural regions.

¹⁵ Bede, *Ecclesiastical History*, Book IV, Ch 19, 237.

Italy, with its long coastlines and central location in the Mediterranean, would have been especially prone to outbreaks and this seems to have been the case. The spread of the plague to northern Italy is mentioned in Paul the Deacon's *Historia Langobardorum*. Paul was a Benedictine monk and the historian of the Lombards living in the eighth century. His perspective is the Lombard perspective. We have already heard some about the Lombards in Gregory's account and Paul provides more detail. Here is Paul's description of an outbreak in Liguria in Northern Italy in A.D. 566.

*In the times of this man a very great pestilence broke out, particularly in the province of Liguria. For suddenly there appeared certain marks among the dwellings, doors, utensils, and clothes, which, if any one wished to wash away, became more and more apparent. After the lapse of a year indeed there began to appear in the groins of men and in other rather delicate places, a swelling of the glands, after the manner of a nut or a date, presently followed by an unbearable fever, so that upon the third day the man died.*¹⁶

The description is characteristically that of Bubonic plague. The "date" like swellings could only have been buboes. The same stories found in other sources are repeated in this one. So many died that there was no one to bury them; prosperous towns, villas, and farms were abandoned with no one to tend crops or flocks. Paul claims that "these evils happened to the Romans only and within Italy alone, up to the boundaries of the nations of the Alamanni and the Bavarians."¹⁷ He also mentions that the plague touched Ravenna and places "which were around the shores of the sea," consistent with Procopius' claim that it affected the coast first.¹⁸ Paul also places part of the success of the Lombard invasion on the outbreak of plague among the Byzantine troops.¹⁹ The first outbreaks occurred in Italy before the invasion of the Lombards, therefore clearing the way for the Lombard invasion. From Paul's account we can say that the plague in Italy was as

¹⁶ Paul the Deacon, *History of the Langobards*, (Philadelphia: University of Pennsylvania Press, 1975), Book II, Ch. 4.

¹⁷ Paul the Deacon, *History of the Langobards*, Book II, Ch. 4.

¹⁸ Paul the Deacon, *History of the Langobards*, Book IV, Ch. 14.

¹⁹ Paul the Deacon, *History of the Langobards*, Book II, Ch. 26.

infectious and deadly as elsewhere, and that it also had political implications like those mentioned by Gregory of Tours. In total Paul describes four outbreaks of plague in different periods, so as elsewhere we have evidence that the disease was reoccurring.

Paul and Gregory both mention a disease outbreak in the city of Rome itself following a flood. Gregory pinpoints the year to 590 AD and mentions that the presiding Pope, Pope Pelagius, immediately caught the disease and perished.²⁰ Paul describes the same devastation following the flood, “straightway a very grievous pestilence called inguinal followed this inundation, and it wasted the people with such great destruction of life that out of a countless multitude barely a few remained.”²¹ The accounts of Gregory and Paul are nearly the same, independently verifying the inundation and following devastation of Rome. The events in Rome show that perhaps the combination of a higher population density, proximity to the coast, and lack of environmental maintenance altogether contributed to the likelihood of an outbreak. In any case the dual infection of Rome and Constantinople meant that even the gems of the civilized world were not immune to infection.

It is not easy to pinpoint the absolute end of the Justinianic plague, or what kind of shape that ending took. Whether the high mortality rate caused the communicability of the disease to decline with population or if people simply adapted to living with the disease until it dissipated is not yet clear. However, the lack of any primary source that specifically mentions a general end to the plague suggests that the disease dissipated over a long period of time rather than suddenly, and therefore its disappearance was not visibly significant to chroniclers.

Identification of the Disease

²⁰ Gregory of Tours, *History of the Franks*, Book X, Ch. 1, 543.

²¹ Paul the Deacon, *History of the Langobards*, Book 3, Ch. 24.

Due to the variable amount of evidence we have on disease throughout history, comparison between historical periods or the diachronic study of disease has been the response. The historiography of plague has been especially shaped in this light. When considering the Justinianic plague, historians have compared written evidence of the plague from the sixth century to later reports of the bubonic plague. The identification of bubonic plague as the disease of the Justinianic plague “is as close to certain as is possible on the basis of written sources.”²² Though the connection between these two plagues was established through primary sources, the agent of the disease is only ascertainable through scientific study, which has been unavailable until recently. Modern knowledge of pathology and DNA analysis has reinvigorated the debate with strong evidence supporting *Yersinia pestis* as the causative disease agent of the Black Death.²³ In 2010 an extensive survey showed that data from “widely distributed mass plague pits” dating from the Middle Ages “unambiguously demonstrates that *Y. pestis* was the causative agent of the epidemic plague that devastated Europe during the Middle Ages.”²⁴ Still, others argue that *Y. Pestis* is not sufficient to cause an epidemic like the Black Death and point to a combination of factors, even a combination of diseases, that made up these epidemics. These researchers cite the absence of *Y. Pestis* DNA in some plague victims as well as the dissimilarity between modern plague and historic plague.²⁵ An

²² Peter Sarris, “The Justinianic Plague: Origins and Effects,” *Continuity & Change* 17, no. 2 (August 2002): 170.

²³ Michel Drancourt, Michel Signoli, La Vu Dang, Bruno Bizot, Véronique Roux, Stéfan Tzortzis, and Didier Raoult. “Yersinia Pestis Orientalis in Remains of Ancient Plague Patients,” *Emerging Infectious Diseases* 13, no. 2 (February 2007): 332–333.

²⁴ Stephanie Haensch, Raffaella Bianucci, Michel Signoli, Minoarisoa Rajerison, Michael Schultz, Sacha Kacki, Marco Vermunt, et al. “Distinct Clones of Yersinia Pestis Caused the Black Death,” *PLoS Pathogens* 6, no. 10 (October 2010), 5.

²⁵ Gilbert M, Thomas P, Jon Cuccui, William White, Niels Lynnerup, Richard W Titball, Alan Cooper, and Michael B Prentice. “Absence of Yersinia Pestis-specific DNA in Human Teeth from Five European Excavations of Putative Plague Victims,” *Microbiology (Reading, England)* 150, no. Pt 2 (February 2004): 341–354; Samuel K Cohn Jr, “Epidemiology of the Black Death and Successive Waves of Plague,” *Medical History. Supplement*, no. 27 (2008): 74–100.

alternative theory suggests the disease to be a reoccurring viral haemorrhagic fever, with its precursors taking the form of the Plague of Athens and the Justinianic Plague.²⁶

Research on the Justinianic plague itself is lacking, and knowledge we have about the pathology of this disease is based on its tenuous connection to the 14th century plague pandemic known as the Black Death. Lester K. Little comments on this predicament, “What is utterly astonishing is the lack of attention shown to the first pandemic by the numerous experts on the second one.”²⁷ The difficulty in plague study is established in the necessity of interdisciplinary approaches.²⁸ Typically what is required is specialty in history, archaeology, paleopathology, microbiology, epidemiology, geography, and many other disciplines but rarely does one individual have the necessary expertise on their own, requiring cooperation across fields and disciplines that is not always forthcoming. However, some progress has been made and the remains of early medieval skeletons in Bavaria have been found to contain evidence of *Y. Pestis*, indicating that the causative agent of this epidemic was likely the same as that of the later Black Death.²⁹ If this evidence holds up, what we cannot reveal about the Justinianic Plague through documental evidence and fieldwork, we can suggest indirectly through comparison to the later Bubonic epidemics.

The use of the catch-all term “plague” or “pestilence” in translation of historical sources that mention some kind of disease in the 6th and 7th centuries hinders the identification of the disease in these sources. The best response is to diagnose the disease through symptoms described in primary sources. When diagnosing bubonic plague this

²⁶ Duncan, C, and S Scott. “What Caused the Black Death?” *Postgraduate Medical Journal* 81, no. 955 (May 2005): 315–320.

²⁷ Little, *Plague and the End of Antiquity*, 16

²⁸ Little, *Plague and the End of Antiquity*, 17

²⁹ Ingrid Wiechmann, and Gisela Grupe, “Detection of *Yersinia Pestis* DNA in Two Early Medieval Skeletal Finds from Aschheim (Upper Bavaria, 6th Century A.D.),” *American Journal of Physical Anthropology* 126, no. 1 (January 2005): 48–55.

method mainly relies on identifying the characteristic buboes, which are indeed mentioned in Procopius, Gregory of Tours, and Paul the Deacon, with possible identification of this symptom found in Bede's *Ecclesiastical History*. This symptom is rarely described more than once in these texts, likely because the authors understood later outbreaks of plague to be a continuation of the same disease and therefore saw no need to describe the symptoms again. Often the disease is referred to as inguinal, or of relating to the groin, which is semantically similar to the term bubonic. When primary sources use this term, as Paul the Deacon does, it likely refers to bubonic plague. Robert Sallares summarily believes that "when the constant references to buboes in all our sources for the Justinianic Plague are added to all the other symptoms that are also features of the bubonic plague... there is no doubt that *Y. Pestis* caused the Justinianic Plague."³⁰ Even though descriptions of the plague in primary sources strongly indicate bubonic plague, certainty about the identity of the disease is unattainable until scientific evidence confirms the presence of *Y. Pestis* DNA in plague victims from the 6th and 7th centuries.³¹

Etiology of Disease

Modern approaches to disease usually begin by asking, "what was it"? The answers to that question in the 21st century would differ dramatically from those of the contemporary historical period of the disease in question. There is some measure of anachronism introduced when disease is explained in modern etiological terms because past peoples did not think about disease in such terminology.³² Peoples experiencing the

³⁰ Little, *Plague and the End of Antiquity*, 237-238.

³¹ Though the evidence of *Y. Pestis* in early medieval skeletons from Bavaria is exciting in this regard, one should be careful about making a claim based on a small sample, and therefore broader study will be necessary to confirm bubonic plague as the general cause of the plague epidemics of 6th and 7th centuries.

³² Little, *Plague and the End of Antiquity*, 43. Here I draw mainly on the discussion invoked by Jo N. Hays in the essay "Historians and Epidemics." The 15th century understanding of syphilis as another pox disease rather than as a disease caused by the microorganism *Treponema pallidum* seems analogous to the situation of plague and its understanding in 6th century.

Justinianic plague did not understand it as a phenomenon caused by the bacterium *Y. Pestis*. Disease in the period between 500 and 750 was still seen as a product of the supernatural. Even humoral medicine could not wholly escape this understanding. Therefore our primary sources tend to explain disease in a way that correlates with a divine etiology. This is often represented through prodigies or by placing disease in a didactic religious context.

Gregory of Tours indicates that often prodigies preceded the plague and he describes the prodigies of the plague outbreak in AD 571 at Auvergne,

Three or four great shining lights appeared round the sun, and these the country folk also called suns... Then a star, which some call a comet, appeared over the whole region for a whole year... In one of the churches of Clermont-Ferrand, while early-morning matins were being celebrated on some feast-day or other, a bird called a crested lark flew in, spread its wings over all the lamps which were shining and put them out so quickly you would have thought someone had seized hold of them all at once and dropped them into a pool of water.³³

In 580 Gregory mentions another set of prodigies, which included natural disasters such as floods, earthquakes, and fires. “A most serious epidemic followed these prodigies” similar to the event at Auvergne, but this time the disease was dysentery.³⁴ In this instance Gregory says, “many people maintained that some secret poison must be the cause of this.”³⁵ The symptoms of the disease, vomiting and body aches, may have inclined people to suspect a less supernatural cause compared to the plague, however some kind of natural etiology is overlooked in the mind of Fredegund, who blames the death of her two sons from the disease on the sin of herself and Chilperic. The following account even mentions that King Guntram’s wife, suffering from the same disease, ordered the death of her doctors as she was dying because she believed them at fault for

³³ Gregory of Tours, *History of the Franks*, Book IV, Ch. 31, 225-226.

³⁴ Gregory of Tours, *History of the Franks*, Book V, Ch. 33-34, 295-296. Gregory labels this disease as dysentery, which could suggest that when he says plague he really does mean plague and not some generic disease or group of diseases.

³⁵ Gregory of Tours, *History of the Franks*, Book V, Ch. 33-34, 296.

her demise.³⁶ Clearly in the accounts of Gregory the explanations for disease were not based on modern disease theory, and even in the common belief that the dysentery episode was caused by a poison it was “some secret poison” rather than what we would understand as contamination.

Bede mentions one account in a pattern similar to that found in Gregory of Tours. In the year AD 664 there was a lunar eclipse, which was then followed by a “sudden plague” which reportedly affected southern Britain and Northumbria.³⁷ Like the astral events or natural disasters in Gregory of Tours, the eclipse acts as a prodigy of imminent disease. The largest focus of illness in his text is on miraculous cures that happen as a result of prayers, saints, or relics. Of particular potency is anything related to King Oswald. From this perspective it is clear that Bede believes disease curable by repentance and devotion to God, which can usually be confirmed by the use of relics. Disease plays an initiatory role in edifying Bede’s audience about the power of God in both death and recovery.

Paul the Deacon also describes some manner of portents preceding disease, like the “certain marks” which appeared on houses, utensils, and clothes prior to the disease at Liguria in AD 566.³⁸ There are also the reports of floods preceding plagues in Rome, which mirror the natural disasters found to precede disease in the account of Gregory of Tours. Another outbreak of disease at Rome was preceded by an astral event:

*In these times during the eighth indiction (A.D. 680) the moon suffered an eclipse; also an eclipse of the sun occurred at almost the same time on the fifth day before the Nones of May about the tenth hour of the day. And presently there followed a very severe pestilence for three months...*³⁹

³⁶ Gregory of Tours, *History of the Franks*, Book V, Ch 35, 298.

³⁷ Bede, *Ecclesiastical History*, Book III, Ch 27, 194.

³⁸ Paul the Deacon, *History of the Langobards*, Book II, Ch. 4.

³⁹ Paul the Deacon, *History of the Langobards*, Book VI, Ch V.

In this account Paul also mentions that “it visibly appeared to many that a good and a bad angel proceeded by night through the city” marking the houses which suffered great death the next day.⁴⁰ This manifestation of the supernatural in the form of angels or spirits is not uncommon in the accounts of our authors.

The similarity in the cosmic and divine events that surround disease in the texts of Gregory, Bede, and Paul may be because they are all church figures and as such derive much of their meaning from a shared belief in the supernatural. One would expect different from Procopius, who is merely a scholar, but even what he has to say about the causes of disease refutes the idea that it could be natural and not supernatural.

Now in the case of all other scourges sent from Heaven some explanation of a cause might be given by daring men, such as the many theories propounded by those who are clever in these matters; for they love to conjure up causes which are absolutely incomprehensible to man, and to fabricate outlandish theories of natural philosophy, knowing well that they are saying nothing sound, but considering it sufficient for them, if they completely deceive by their argument some of those whom they meet and persuade them to their view. But for this calamity it is quite impossible either to express in words or to conceive in thought any explanation, except indeed to refer it to God.⁴¹

Procopius does not stop there:

Apparitions of supernatural beings in human guise of every description were seen by many persons, and those who encountered them thought that they were struck by the man they had met in this or that part of the body, as it happened, and immediately upon seeing this apparition they were seized also by the disease. Now at first those who met these creatures tried to turn them aside by uttering the holiest of names and exorcising them in other ways as well as each one could, but they accomplished absolutely nothing, for even in the sanctuaries where the most of them fled for refuge they were dying constantly.⁴²

Even our more secular author does not hesitate to describe supernatural events as though they were real. The tendency for apparitions, demons, and angels, to be pervasive in descriptions of plague is likely heightened by the novelty of the disease. Because the

⁴⁰ Paul the Deacon, *History of the Langobards*, Book VI, Ch V.

⁴¹ Procopius, *History of the Wars*, Ch. XXII.

⁴² Procopius, *History of the Wars*, Ch. XXII.

plague is unfamiliar and there is less knowledge about it, it is easier to attribute to it supernatural causes. Additionally the wide scale of the disease and its indiscriminate nature meant that logically in the thinking of the time it was a punishment sent by God to the whole of humanity.

The approach to epidemics in modern study has been long informed by disease theory, which rejects any supernatural explanation of disease. But even with a scientific understanding of disease, epidemics of the past remained anomalies to historians. William McNeill claimed in *Plagues and Peoples* that “Epidemic disease, when it did become decisive in peace or in war, ran counter to the effort to make the past intelligible. Historians consequently played such episodes down.”⁴³ McNeill attempted to correct the perceived unpredictability of disease and “bring the history of infectious disease into the realm of historical explanation.”⁴⁴ His effort renewed interest in ancient epidemics and in due course historians have sought to explain them through historical methodology. This approach is qualitative; the emphasis is not on understanding the spread of disease through numbers but rather through determining social and cultural factors of epidemiology in a historical context. In such a comprehensive way scholars have looked at early medieval Europe as a region that was particularly ripe for disease. Various theories explain the rise of disease in this period. The fall of the Western Roman Empire debilitated Roman baths and drainage networks, reducing sanitation and leaving stagnant water, which bred malaria. Interruption of Roman agriculture left populations with poor nutrition and therefore less ability to resist disease. Migratory peoples could easily transmit diseases as they spread throughout the continent and came into contact with

⁴³ William H. McNeill, *Plagues and Peoples*, (Garden City: Anchor Press, 1976), 4.

⁴⁴ McNeill, *Plagues and Peoples*, 4.

previously unknown diseases. Accordingly the Justinianic plague was the logical outcome of a virgin soil epidemic occurring among weakened populations.

Other diseases, such as malaria, have become the focus of research as historians seek to understand local phenomena of health. These less deadly diseases are chronic factors in lifespan and health, contributing to mortality by increasing vulnerability to other diseases and reducing the impact of good nutrition. Their visibility is not as strong as plague in primary sources, although some references in documental evidence can be inferred to be variations of these less acute diseases rather than plague. Suffice to say, just as the more pressing epidemic diseases have caught the attention of past chroniclers, so have these diseases preoccupied researchers, meaning that the body of evidence and research into less deadly chronic endemic diseases is not as extensive as research into plague.

Presumptions that were founded on primary source evidence and analogies to recent historical epidemics are now being tested through new methodology. DNA, isotope, and skeletal analysis have been particularly influential, allowing researchers to identify pathogens, diet, and the nutritional environment of deceased individuals from their skeletal remains. From this angle of study we can now identify what disease affected an individual during their youth, what they ate when they were young, whether they were anemic, where they grew up, and a host of other factors that let us construct the health and identity of an individual. Not only can this new evidence be used to uncover evidence of Justinianic plague in late antiquity, it can also be used to reveal the living standards of populations in the following period.

The greatest limit on the application of this research is its cost. Archaeological excavation itself is expensive, but the process of analyzing skeletal remains only adds to

that expense. This work is also not as appealing, especially since the results were limited until recently, and therefore less effort has gone into post-excavation analysis.

Consequently, most skeletal analysis is performed on already excavated sites where researchers rely on site reports to find data. These reports often already include calculated stature tables or lists of pathological anomalies and the researcher simply extracts this data into a database. On the local scale the data is very reliable; it is possible to identify the diet and pathological afflictions of individuals. It is even possible to identify the general health regimen at a site within a specific period, but to take it further the researcher has to rely on multiple samples to create a statistically significant sample size. This is especially true when trying to build a database of metric data used to compare statistics or demographics from different chronological periods. Any abstraction of data creates potential inaccuracies, but for the most part researchers have tried to limit these by reducing sources of inaccuracy, such as accounting for infant mortality when calculating the mortality rate. Lively debate between historians also shows that usage of this data is open to criticism and there is some limit to what can be interpreted by the data.⁴⁵ This is more than can be said for some historical interpretations based on documental evidence.

Applying scientific methods to the study of Justinianic plague and the proceeding demography has yielded interesting results that contrast with the former expectations of historians. The study of stature and nutrition in the 6th and 7th centuries has particularly shown that the previous conceptions of this period as a general decline in terms of health are not wholly accurate.

⁴⁵ Walter Scheidel, "Roman Wellbeing and the Economic Consequences of the 'Antonine Plague'," *SSRN eLibrary* (November 10, 2009). This article is an example of one historian contesting the interpretation of this data by another.

Stature

Though stature is linked to some hereditary genes, it functions as a proxy for the factors of nutrition and health.⁴⁶ Access to a better diet encourages growth, and resistance to disease helps to prevent pathological detriments to stature. The study of stature is placed under auxology, the study of human growth, and this study has been used to demonstrate trends in nutrition and health throughout periods of time including recent historical periods. There are various methods of measuring stature based on skeletal remains but the majority of the methods rely on measuring the long bones, typically the femur, and then applying a regression equation based on proportions of bone length to stature.⁴⁷ Usually this process is performed in post-excavation analysis and the results are published in the field reports. When multiple samples are combined to create a metric database they can incorporate multiple regression methods but returning to the original bone lengths and recalculating stature with the same formula for all samples can solve this problem.

A few studies are relevant to our period of focus and I begin with Koepke and Baten's article "The Biological Standard of Living in Europe During the Last Two Millennia." This article focuses on the differing impacts of nutrition and population density on stature and growth, but the authors have also undertaken extensive research in order to construct a metric survey of heights throughout the first millennium. Samples are taken from dates throughout the first and second millennia and stature estimates typically

⁴⁶ The causal relationship between stature and economic performance is still under investigation, see Walter Scheidel, "Physical Wellbeing in the Roman World." for a discussion of the usefulness of stature as a proxy of wealth.

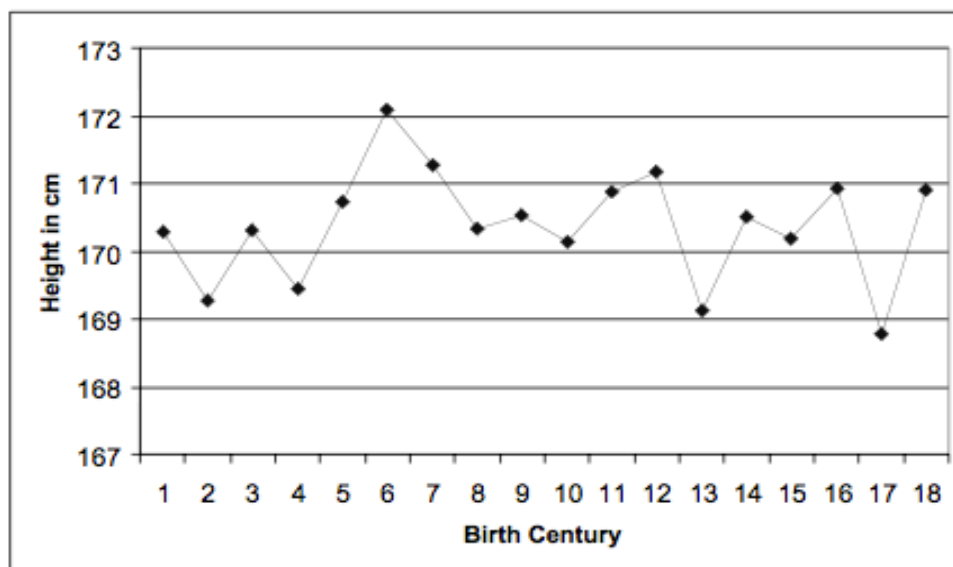
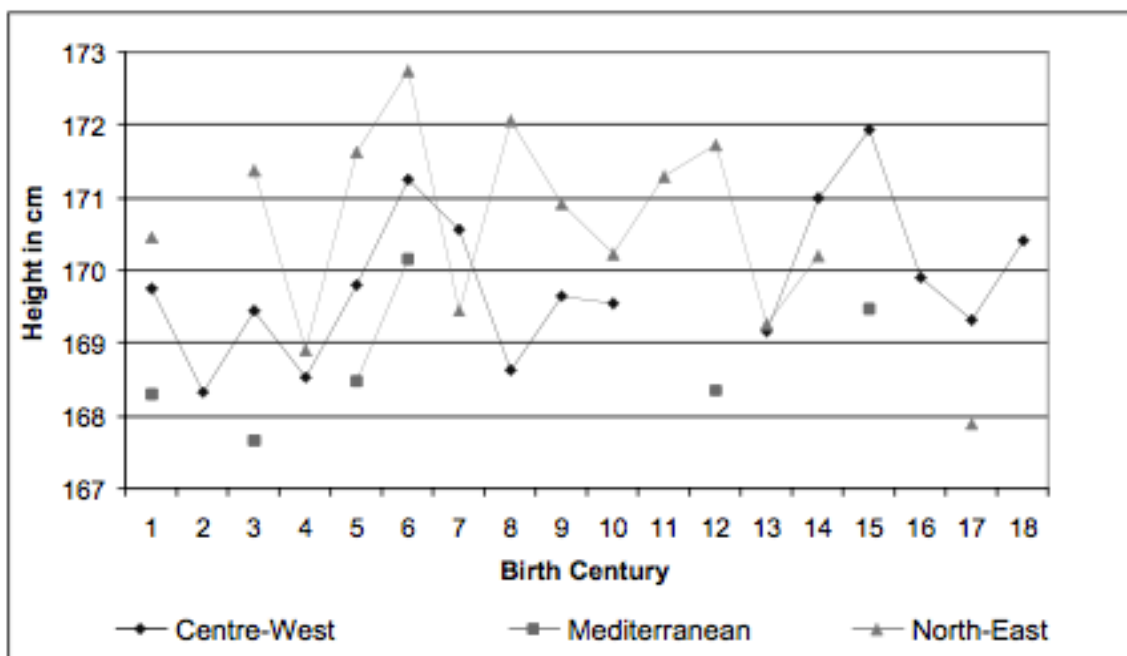
⁴⁷ Monica Giannecchini and Jacopo Moggi-Cecchi, "Stature in Archeological Samples from Central Italy: Methodological Issues and Diachronic Changes," *American Journal of Physical Anthropology* 135, no. 3 (March 2008): 284–292. Here the various equations and methods available have been tested for accuracy in Italian skeletal samples. This article serves as a decent summary of the methods used in calculating stature.

come from long bone measurements of skeletons but later centuries (16th and 17th) incorporate stature estimated from body armor.⁴⁸ They favor using the Breitingen/Bach regression formula for estimating stature and have recalculated estimated statures that did not make use of that formula.⁴⁹ Their results show that compared to other centuries, there is a definite rise in the average height in the 6th and 7th centuries following the first outbreaks of plague. As exemplified by the second graph, there are some missing links in regional data but trends are still visible even in the Mediterranean plotline. Moreover, the upturn in height is confirmed in Italy through the study of Barbiera et al. “Population Dynamics in Italy in the Middle Ages: New Insights from Archaeological Findings,” which discusses population dynamics in Italy around and during this period.⁵⁰

⁴⁸ Nikola Koepke and Joerg Baten, “The Biological Standard of Living in Europe During the Last Two Millennia,” *European Review of Economic History* 9, no. 01 (2005): 66-69.

⁴⁹ Koepke and Baten, “The Biological Standard of Living,” 71.

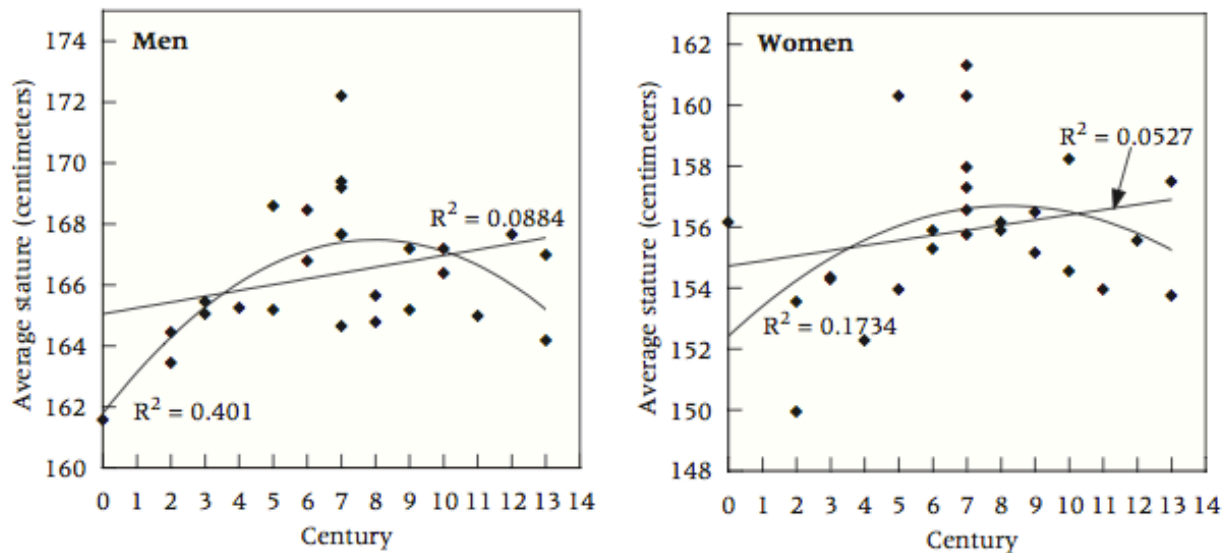
⁵⁰ Irene Barbiera and Gianpiero Dalla-Zuanna, “Population Dynamics in Italy in the Middle Ages: New Insights from Archaeological Findings,” *Population and Development Review* 35, no. 2 (June 1, 2009): 375.

Developing height by century (in cm).⁵¹Developing height by century and region (in cm).⁵²

⁵¹ Koepke and Baten, "The Biological Standard of Living," 76.

⁵² Koepke and Baten, "The Biological Standard of Living," 77.

FIGURE 2 Average stature (in centimeters) as indicated by adult skeletons found in Italian cemeteries from the Classical Roman period and the Middle Ages. Data points fitted by a straight line and a parabola



Apparently people were thriving at least in terms of physical growth in the period following the Justinianic plague even in the disease prone-region of Italy. Of course this data must be taken with a grain of salt because it is based on limited archeological data that can always be improved by more excavation, research, or analysis, but the current available data suggests a positive trend in growth following the Justinianic plague. So why the sudden upsurge in height following a period of death and decay? The best way to answer this question is to investigate factors which affect stature, namely nutrition and population dynamics, as our above authors have done.

Nutrition

The primary sources are silent on the topic of diet except when they describe feasting or the dietary customs of foreign peoples. The diet described in these special circumstances is presumably not representative of the daily diet. Therefore most information on this topic comes from analysis of skeletal remains, specifically isotope

analysis of carbon and nitrogen. By looking at the abundance of certain isotopes of these elements in the preserved remains of skeletons, we can identify the make-up of ancient diets. Diet can also leave certain marks on the skeleton and dentistry. Carbohydrate-heavy diets tend to increase the amount of cavities found in teeth; iron deficient diets increase osteoporosis in skull bones. There are other methods of revealing diet, namely through paleoethnobotany, which studies preserved ecofacts such as seeds and pollen. These things can reveal the cultivation of certain plants. A combination of the above methods gives a solid picture of diet, but usually only one or two of these methods is necessary to obtain a useful idea of what was being consumed.

Diet is the result of adaptive subsistence strategies to a particular environment. Accordingly, nutrition is very dependent on geography, making it difficult to generalize about nutrition in the vastness of the former Western Roman Empire. However, we can approach the subject of nutrition on a micro level, and perhaps draw broader conclusions based on a smaller scale. The typical Roman Italian diet was characterized by high consumption of carbohydrates, as evidenced by high levels of dental cavities and a carbon isotope signature indicating consumption of cereals and grains.⁵³ This reflects a reliance on agriculture and sedentary subsistence methods. In communities close to the coast, diet was likely complemented by an exploitation of marine resources for protein.⁵⁴ Koepke and Baten have indicated that pigs were consumed in the urban areas of the Roman Empire, especially in the Mediterranean, so in these areas of Italy pigs may have contributed protein to the diet as well.⁵⁵ The Roman Italian diet was not particularly rich

⁵³ Tracy Prowse, Henry P. Schwarcz, Shelley Saunders, Roberto Macchiarelli, and Luca Bondioli. "Isotopic Paleodiet Studies of Skeletons from the Imperial Roman-age Cemetery of Isola Sacra, Rome, Italy," *Journal of Archaeological Science* 31, no. 3 (March 2004): 259–272.

⁵⁴ Prowse, "Paleodiet Roman-age Cemetery," 270.

⁵⁵ Koepke and Baten. "The Biological Standard of Living," 65.

in terrestrially derived proteins, and even the consumption of fish or other marine proteins would have been a luxury.⁵⁶ Accordingly statures of Mediterranean and Italian Romans were quite modest.

It appears that later populations did not diverge dramatically from the Roman Italian diet with the exception of terrestrial meat consumption. Belcastro and others suggest that the consumption of pastoral animals, specifically cattle, increased with the movement of Germanic peoples into the area.⁵⁷ Barbiera and others argue that the diet of populations in early medieval Italy was actually quite good compared to the Roman period.⁵⁸ This argument can be supported on the basis of lower population densities and increased exploitation of cattle.⁵⁹ The trauma of Roman political decline in the peninsula, followed by the Gothic Wars beginning in 535 and the Justinianic Plague in 542, could have reduced population sizes across the peninsula, creating a “low-pressure” environment that encouraged the use of land-intensive pastoral resources.

The increased use of cattle in Italy resembles subsistence strategies already found among Germanic peoples. The investigations of Koepke and Baten have shown that beef and milk were heavily exploited by Germanic peoples in northern, eastern, and central Europe prior to the migration of these peoples into the Empire. This is supported by historical references to the Germanic disposition for consuming milk. A passage in Caesar’s *The Gallic Wars* states that the Germans “do not live much on corn, but subsist

⁵⁶ Prowse “Paleodiet Roman-age Cemetery,” 261.

⁵⁷ Giovanna Belcastro, Elisa Rastelli, Valentina Mariotti, Chiara Consiglio, Fiorenzo Facchini, and Benedetta Bonfiglioli. “Continuity or Discontinuity of the Life-style in Central Italy During the Roman Imperial Age-Early Middle Ages Transition: Diet, Health, and Behavior,” *American Journal of Physical Anthropology* 132, no. 3 (March 2007): 381–394.

⁵⁸ Barbiera, “Population Dynamics in Italy”

⁵⁹ Koepke and Baten, “The Biological Standard of Living,” 65; Barbiera, “Population Dynamics in Italy,” 375.

for the most part on milk and flesh.”⁶⁰ Tacitus in *Germania* mentions that the barbarian diet is composed of “wild fruit, fresh game, and curdled milk.”⁶¹ Thus there is a working hypothesis that Germanic peoples were milk drinkers, and as they migrated into the empire and eventually into Italy, they brought along with them a preference for milk. Milk likely had a larger impact on protein consumption than meat. Milk was generally available to all social classes because its relative abundance and inability to survive transportation meant that local milk prices were kept low.⁶² As far as conditions back at home, the question is not whether Germans made use of milk and beef but whether they made use of agriculture. According to Rosch, the Alemanni during the migration period were using “several cereals as well as oil and fibre plants and pulses.”⁶³ Likely people living in what is today southern Germany continued to cultivate cereals and garden plants introduced into the region by Romans prior to the collapse of Roman authority in the region, although such cultivation would have been simpler than that of the Romans or Celts.⁶⁴ The diet of most Germans would have been flexible and adaptable in the Migration Period, of which exploitation of pastoral resources and seasonal crops is one permutation. Such a diet remained relatively more nutritious than its Roman counterpart, explaining perhaps the taller statures of Germanic peoples, and the increasing stature in later periods as the Germanic diet became more common throughout western Europe.

⁶⁰ Ceasar, *Gallic Wars*, Book 4, Ch 1. Internet Classics Archive, Last accessed December 3, 2012, <http://classics.mit.edu/Caesar/gallic.4.4.html>

⁶¹ Tacitus, *Germania*, Medieval Sourcebook Online, Last accessed December 3, 2012, <http://www.fordham.edu/halsall/source/tacitus1.html>

⁶² Nikola Koepke and Joerg Baten, “Agricultural Specialization and Height in Ancient and Medieval Europe,” *Explorations in Economic History* 45, no. 2 (April 2008): 129.

⁶³ Manfred Rösch, “New Aspects of Agriculture and Diet of the Early Medieval Period in Central Europe: Waterlogged Plant Material from Sites in South-western Germany,” *Vegetation History and Archaeobotany* 17, no. 0 (2008), 236.

⁶⁴ Rösch, “New Aspects of Agriculture,” 236.

From cases in Italy and Germany we can tell that diets were generally adaptive, and the trends in diet often appear counterintuitive to our expectations. But there are cases where diets were not adaptive in the early middle ages. I look mainly to the example of Croatia, which exemplifies the problem that regionalism poses to researching ancient nutrition. Roman Pannonia and Dalmatia, which includes modern day Croatia, was the site of large-scale migrations of Goths, Slavs, Avars, and Croats. Accordingly, Mario Šlaus explains that the transition in Croatia is traditionally thought of “as uniformly catastrophic with destruction of major urban centers, depopulation, famine, and the spread of epidemic diseases.”⁶⁵ In attempting to find if this hypothesis is accurate, Šlaus has looked at the skeletal and dental evidence, in the process revealing changes in diet that occurred over the transition to the early medieval period. The skeletons from the Adriatic region of Croatia show a nutritional deficiency compared to their Roman period counterparts, while skeletons in the interior part of Croatia show no significant change in nutrition.⁶⁶ Šlaus explains this difference through the subsistence strategies of peoples who moved into the region. The Avars and Slavs who moved into interior Croatia were able to exploit resources similar to the regions from which they came, while the Croatians were unable to adapt their skills to exploiting a marine environment like the Adriatic.⁶⁷ The case of Early Medieval Croatia shows that even in areas that are near to each other, the difference in environment can require dramatically different subsistence strategies, resulting in the diverse regional diets. Also shown is that migratory peoples can often have maladaptive subsistence strategies resulting in nutritional deficiencies that are not always predictable.

⁶⁵ Mario Šlaus, “Osteological and Dental Markers of Health in the Transition from the Late Antique to the Early Medieval Period in Croatia,” *American Journal of Physical Anthropology* 136, no. 4 (2008), 455.

⁶⁶ Šlaus, “Osteological and Dental Markers in Croatia,” 464.

⁶⁷ Šlaus, “Osteological and Dental Markers in Croatia,” 465-466.

Regional variation was not the only factor affecting the nutrition of individuals; in many cases social rank determined access to a better diet. In egalitarian societies this was not an issue, but eventually most barbarian groups established some kind of social hierarchy in association with land tenure that developed into nutritional inequality. However, where milk was produced nutritional inequality tended to remain low due to the low price of milk and its high availability.⁶⁸ In societies where cow milk was not commonly consumed, such as among Mediterranean Romans, wealth typically correlated with nutrition because wealthier persons could afford a more varied diet with more protein.⁶⁹ Poorer strata depended on calorie-dense, nutritionally-poor foods like bread. Therefore when we are trying to extrapolate diet from skeletal evidence, we not only have to take into account the past environment, but also the socioeconomic class of individuals being analyzed.

One thing that could counteract the benefits of good nutrition was exposure to chronic disease, such as malaria. Certain diseases leave visible marks on the skeleton, and malaria is potentially detectable through pathologies known as Cribra Orbitalia or Porotic Hyperostosis, which are usually a sign of anemia.⁷⁰ Malaria can cause anemia due to thalassemia, a Mediterranean disease similar to sickle cell, which imparts resistance to malaria in exchange for decreased oxygen capacity in red blood cells. There is also some minor documental evidence that tells us malaria was around certain regions, especially along the coast to Rome. Sidonus Apollinaris in his *Letter to his friend Herenius* writes in 467 AD,

⁶⁸ Koepke and Baten, "Agricultural specialization and height in ancient and medieval Europe," 129.

⁶⁹ For discussion of dietary differences and inequality see the study by Koepke and Baten "The Biological Standard of Living in Europe During the Last Two Millennia." 86-87.

⁷⁰ For a discussion of the causes of these pathologies and their relation to anemia see Phillip L Walker, Rhonda R Bathurst, Rebecca Richman, Thor Gjerdrum, and Valerie A Andrushko. "The Causes of Porotic Hyperostosis and Cribra Orbitalia: a Reappraisal of the Iron-deficiency-anemia Hypothesis." *American Journal of Physical Anthropology* 139, no. 2 (June 2009): 109–125.

I just traversed the other towns of the Flaminian Way---in at one gate, out at the other---leaving the Picenians on the left and the Umbrians on the right; and here my exhausted system succumbed either to Calabrian Atabulus or to air of the insalubrious Tuscan region, charged with poisonous exhalations, and blowing now hot, now cold. Fever and thirst ravaged the very marrow of my being.⁷¹

Apollinarus calls Tuscany “insalubrious” or unhealthy and Tuscany is of course a coastal region. There is also archaeological evidence of epidemic diseases that do not fit into the plague model. One example hails from the site of Lugnano at Terevina, which is near the area travelled through by Apollinarus. A so-called “abnormal burial” suggests some kind of local epidemic and evidence of folk remedies for an enlarged spleen, a possible symptom of malaria, are found at the burial site.⁷² This site predates the Justinianic plague by nearly a century, indicating that some form of malaria was present in this region prior to the plague.

Malaria becomes endemic in regions and chronically affects the lifespan of the population. Individuals who are survivors of malaria or carriers of thalassemia have much less resistance to other disease. When looking at the effects of this disease on stature we are mainly looking at the diversion of resources required to fight chronic illness rather than spent towards growth. As indicated previously, coastal populations and populations near stagnant water were especially exposed to malaria because of an increase in the number of mosquitos, and as evidenced by “high parasitic loads” found in Šlaus’ early medieval skeletal sample of coastal Croatia this seems to be the case.⁷³ While nutrition could have been remarkably good in some regions of post-plague Europe, the incidence of malaria could have increased due to a failure to maintain Roman drainage networks. Yet despite this, stature appears to have increased in this period even in the Italian

⁷¹ Sidonius Apollinaris, Letters. Tr. O.M. Dalton (1915), Book I, 1-33.

⁷² David Soren, “Can Archaeologists Excavate Evidence of Malaria?” *World Archaeology* 35, no. 2 (October 1, 2003), 202.

⁷³ Šlaus, “Osteological and Dental Markers in Croatia,” 467.

peninsula where malaria would have likely been endemic. Whether this is because the healthy leave the most visible skeletal remains is a question that is relevant, but too large to be covered in detail here.⁷⁴

Population Density

The 6th and 7th centuries were characterized by a demographic shift occurring in response to an “epidemiological adjustment,” meaning that as epidemic diseases moved into a previously unaffected area they acted as a virgin soil epidemics, affecting young and old alike, resulting in rapid population decline.⁷⁵ If the population were dense enough the epidemic would become a disease that primarily affected children of survivors, suppressing population recovery until the disease faded. In areas that had low population density, occasional outbreaks would result in major kill-off episodes similar to a virgin soil epidemic, reoccurring in short-term population decline. The lethality of the Justinianic plague meant that it was difficult for it to stay endemic; density-dependent diseases usually work better if they do not kill so efficiently. Therefore, outbreak episodes likely recurred through external introduction, leaving populations to recover in between periods of plague. Endemic instances could only occur in highly populated areas such as Constantinople, where the disease was attested to have remained for four months.⁷⁶ The general result was a recurring kill-off of younger sectors of the population across infected regions, encouraging faster reproduction in order to maintain current levels of population.⁷⁷

⁷⁴ This problem is known as the “osteological paradox” and it spans the scope of paleopathological study. See Lori E Wright, and Cassady J Yoder, “Recent Progress in Bioarchaeology: Approaches to the Osteological Paradox.”

⁷⁵ McNeill, *Plagues and Peoples*, 116.

⁷⁶ Procopius. *History of the Wars*, Book I, Ch. XXII. McNeill, *Plagues and Peoples*, 115-116.

⁷⁷ McNeill, *Plagues and Peoples*, 115-116.

Low population density improves nutrition by allowing land-intensive means of production, such as cattle herding, which generally provide more protein than primarily agricultural systems. As discussed already, this diet would have increased stature. A low population density also reduces transmission of disease because there is less chance of infection between individuals. This had the benefit of improving health, even as Roman sanitation practices began to fade.⁷⁸ Koepke and Baten have estimated that low population density, measured in terms of increased land per capita, had a subordinate role in improving stature when compared to increased cattle share.⁷⁹ However, the exploitation of cattle requires more land than agriculture, and therefore the two factors are interrelated. In any case it appears that lower population density correlates with higher average stature.

Conclusion

As the population in most parts of Europe declined, or was at least stalled, the low density allowed for the development of economic and political systems that could cope with a shortage of labor. Economically this meant a reduction in interstate trade which, coupled with the Arab conquests of North Africa, left the old Roman Mediterranean trade system abandoned. Subsistence strategies shifted towards more land-intensive practices such as pastoralism. This change in subsistence resulted in better diets for egalitarian societies, and in the wake of population shortages most European societies drifted towards more egalitarian practices that were less likely to alienate needed labor. Even where social inequality existed, the production of milk reduced nutritional inequality, allowing for a reliable source of protein for poorer strata, meaning that populations could

⁷⁸ Šlaus, "Osteological and Dental Markers in Croatia," 467.

⁷⁹ Koepke and Baten, "Agricultural specialization and height in ancient and medieval Europe," 140.

generally recover except in cases where another plague outbreak occurred, or where the incidence of malaria negated good nutrition.

A general population decline undermined practices that had relied on abundant labor. Militarily this weakened the Byzantine Empire, which was especially devastated by plague. The first outbreaks of Justinianic plague occurred in the midst of the Gothic Wars, complicating an already complicated situation in the Italian peninsula. Armies were of course sitting ducks for plague and thus the military efforts of both sides during the Gothic Wars were greatly impeded. The cost of losing troops and having to hire mercenaries and replacements put extra weight on the Imperial treasury, which was poorly funded by declining tax revenue from a smaller population. Therefore the plague left the Byzantine treasury overextended on two fronts, and when the Lombards invaded Italy there was no real resistance from either the Goths or Byzantines. The same factors left the former Dalmatian and Pannonian provinces in the hands of Slavs and Avars who saw in the depopulated provinces an opportunity for relocation and settlement.⁸⁰ On the other hand, the barbarian kingdoms did not suffer as much as Byzantium. Rural areas had less to lose from plague outbreaks and much of the land under barbarians was rural. The typical diet of these peoples also allowed a better exploitation of low-density subsistence strategies. Away from the Mediterranean, populations were less likely to encounter endemic diseases like malaria. Therefore Justinianic Plague acted to level the playing field between the regions of Europe, though western polities would still need to develop in order to take advantage of the demographic disparity.

⁸⁰ Arkadiusz Sottysiak, "The plague pandemic and slavic expansion in the 6th-8th centuries," *Archaeologia Polona* 44 (2006): 361.

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